

FIG. 3A

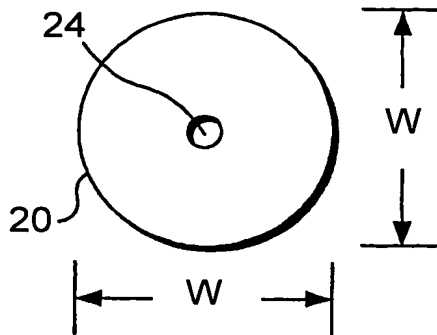


FIG. 3B

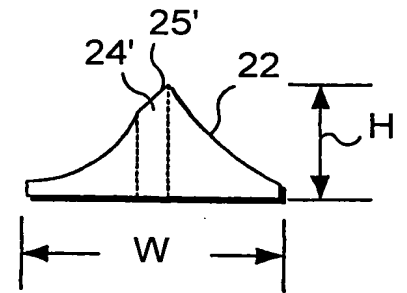


FIG. 4

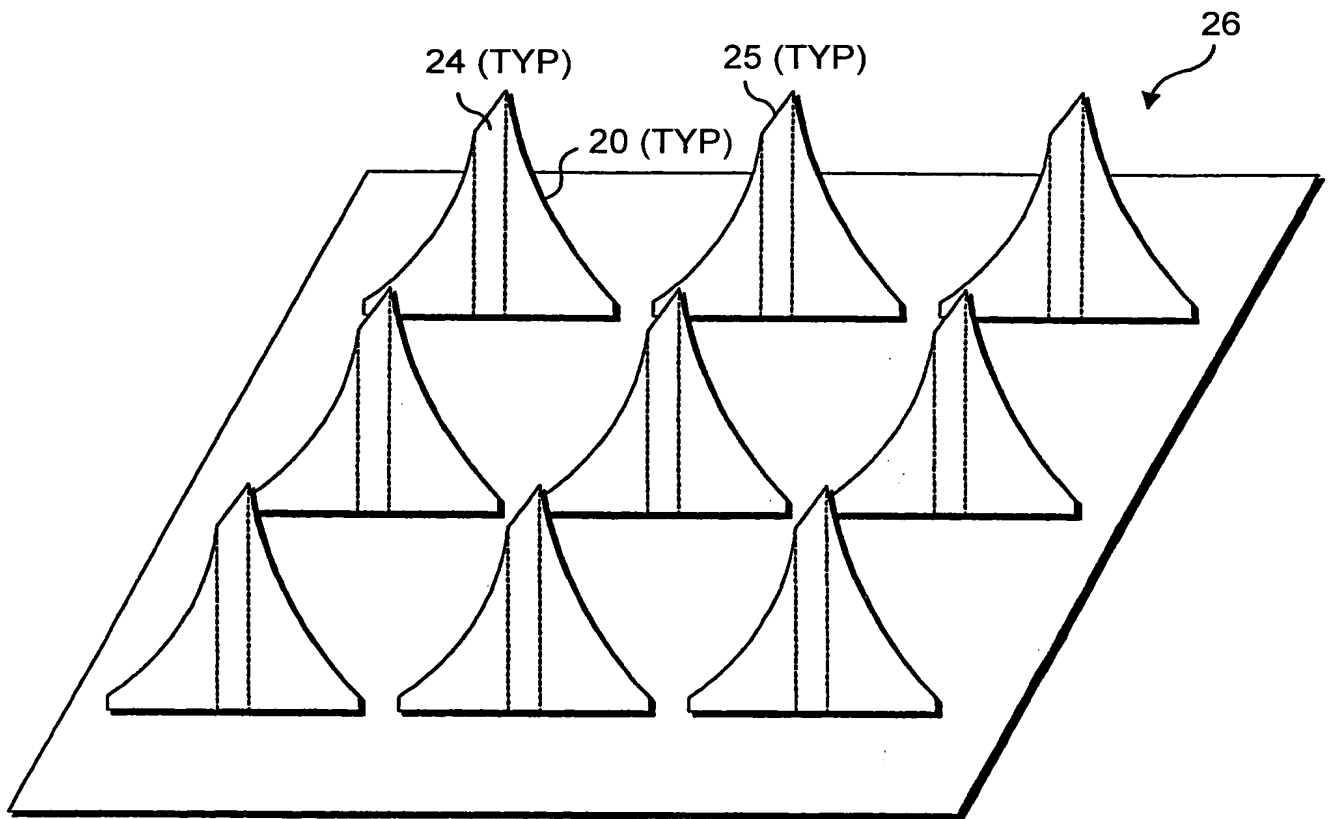


FIG. 5

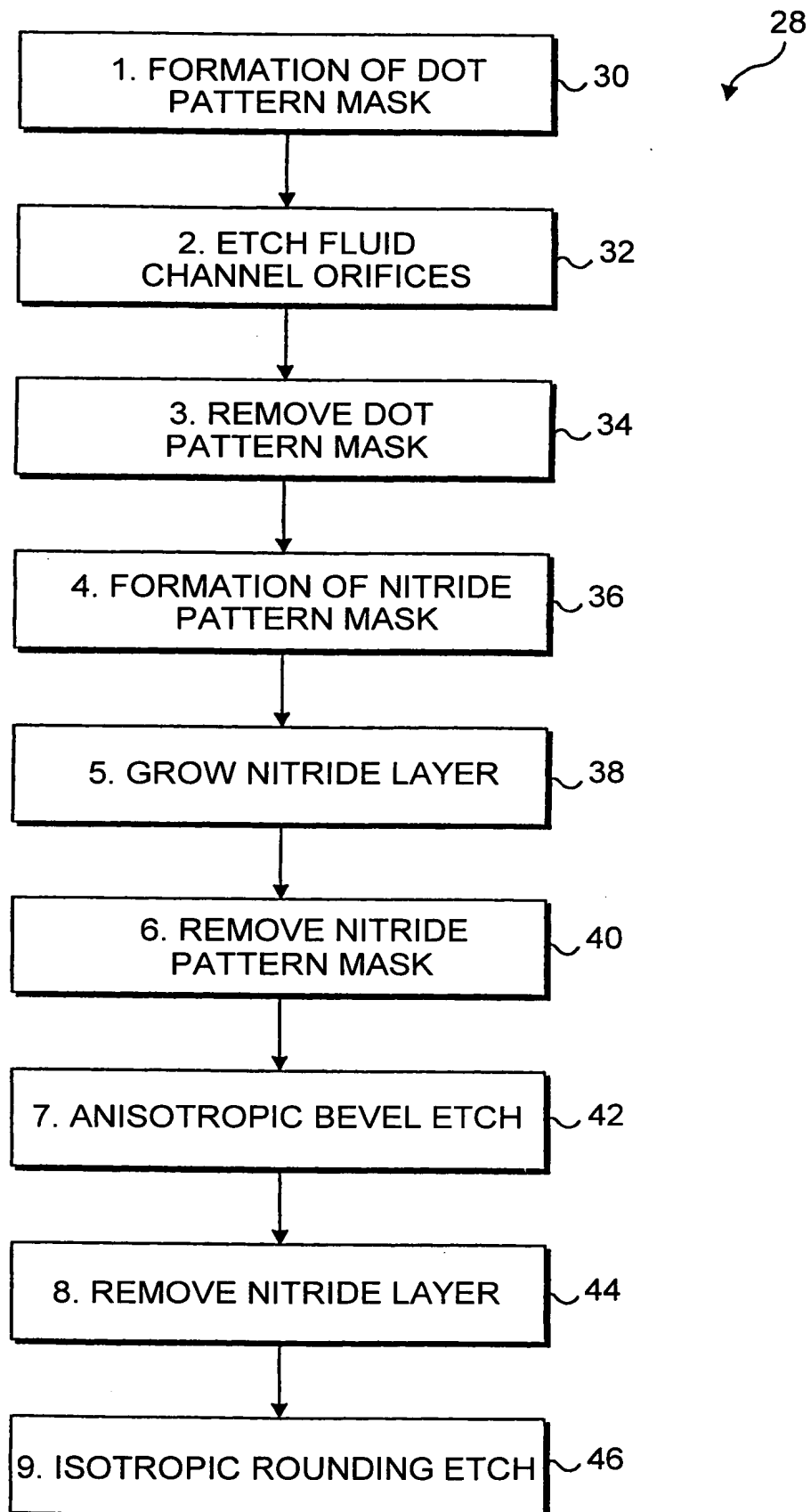
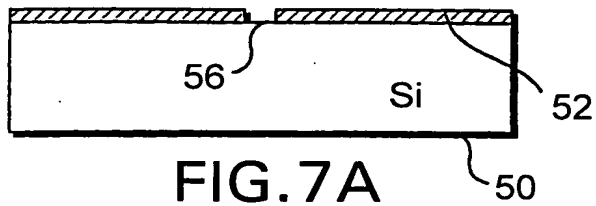


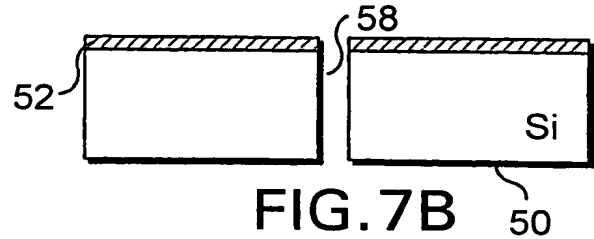
FIG.6

STEP 1. FORM DOT  
PATTERN MASK

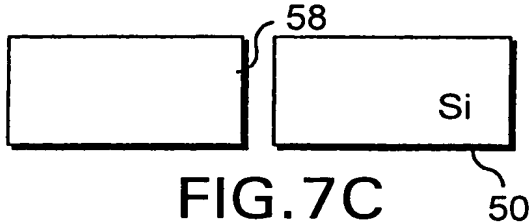
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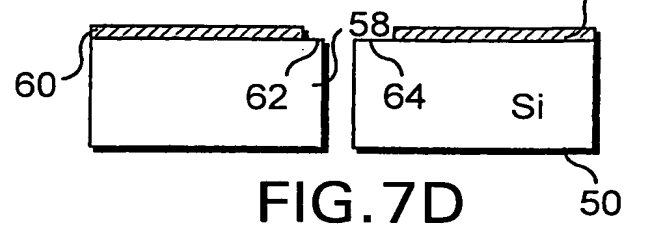
STEP 2. ETCH ORIFICE  
THROUGH SUBSTRATE



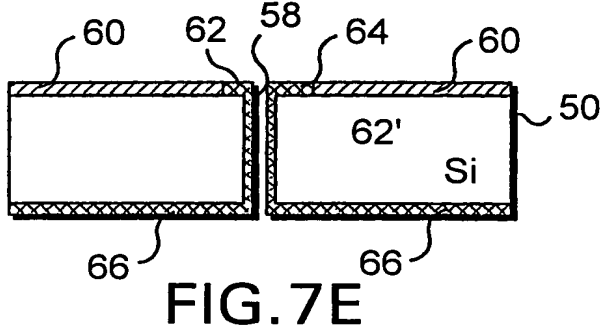
STEP 3. REMOVE DOT  
PATTERN MASK



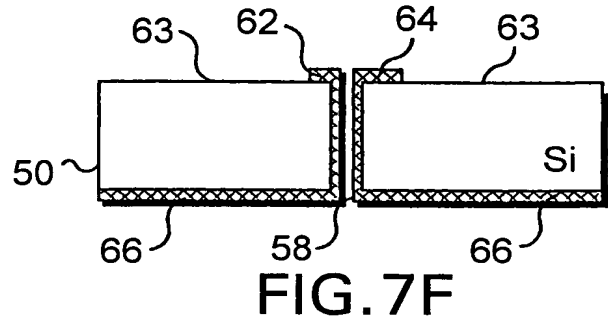
STEP 4. FORM NITRIDE  
PATTERN MASK



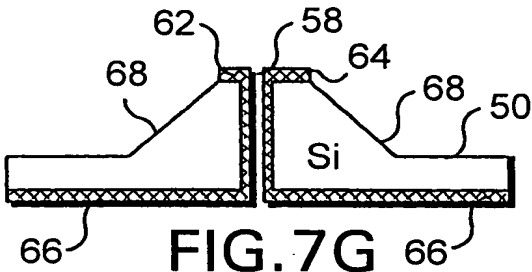
STEP 5. GROW NITRIDE LAYER



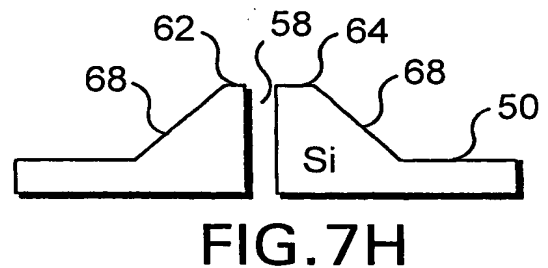
STEP 6. REMOVE NITRIDE  
PATTERN MASK



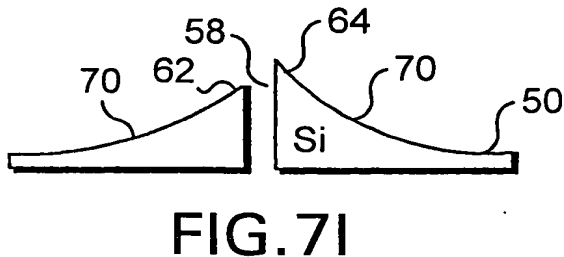
STEP 7. ANISOTROPIC ETCH



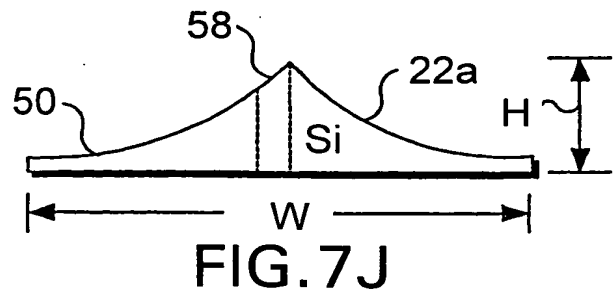
STEP 8. REMOVE NITRIDE LAYER



STEP 8. ISOTROPIC ETCH



FINISHED MICRO-NEEDLE



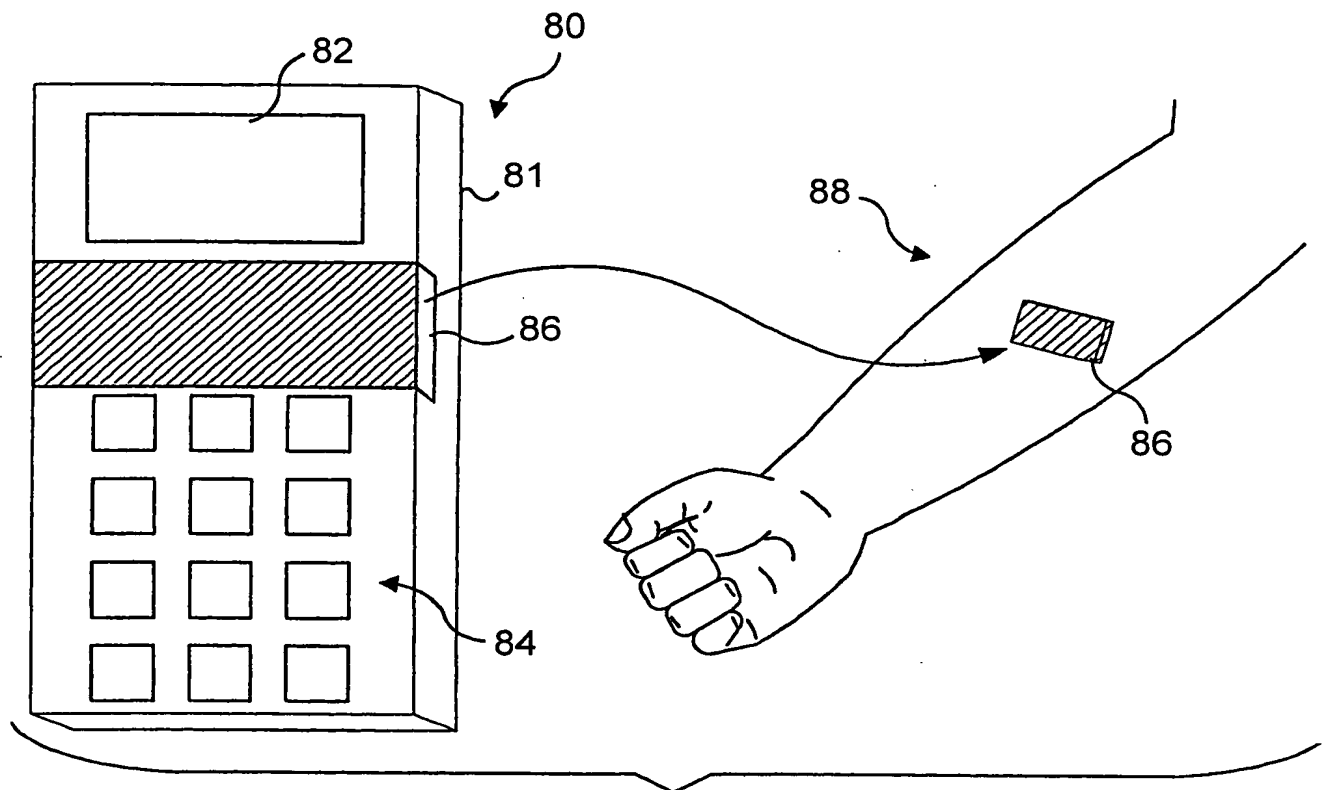


FIG. 8

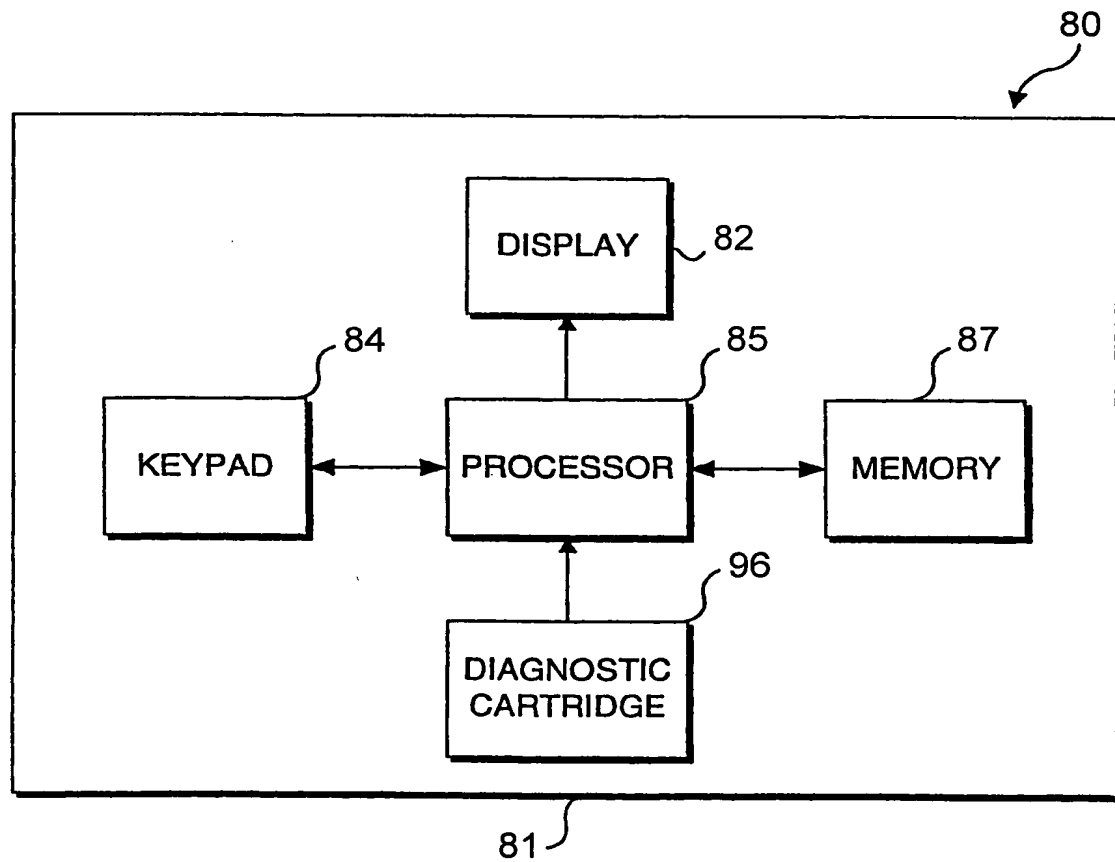
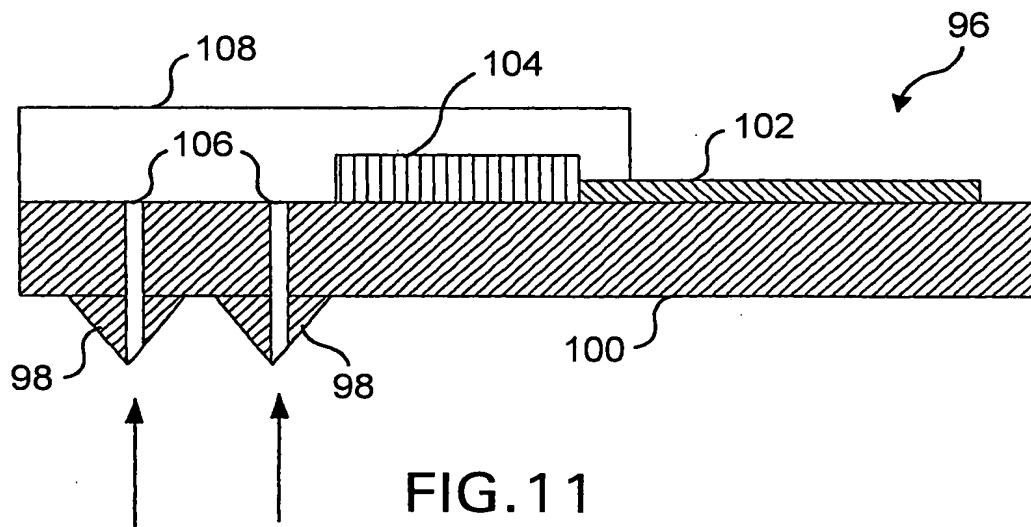
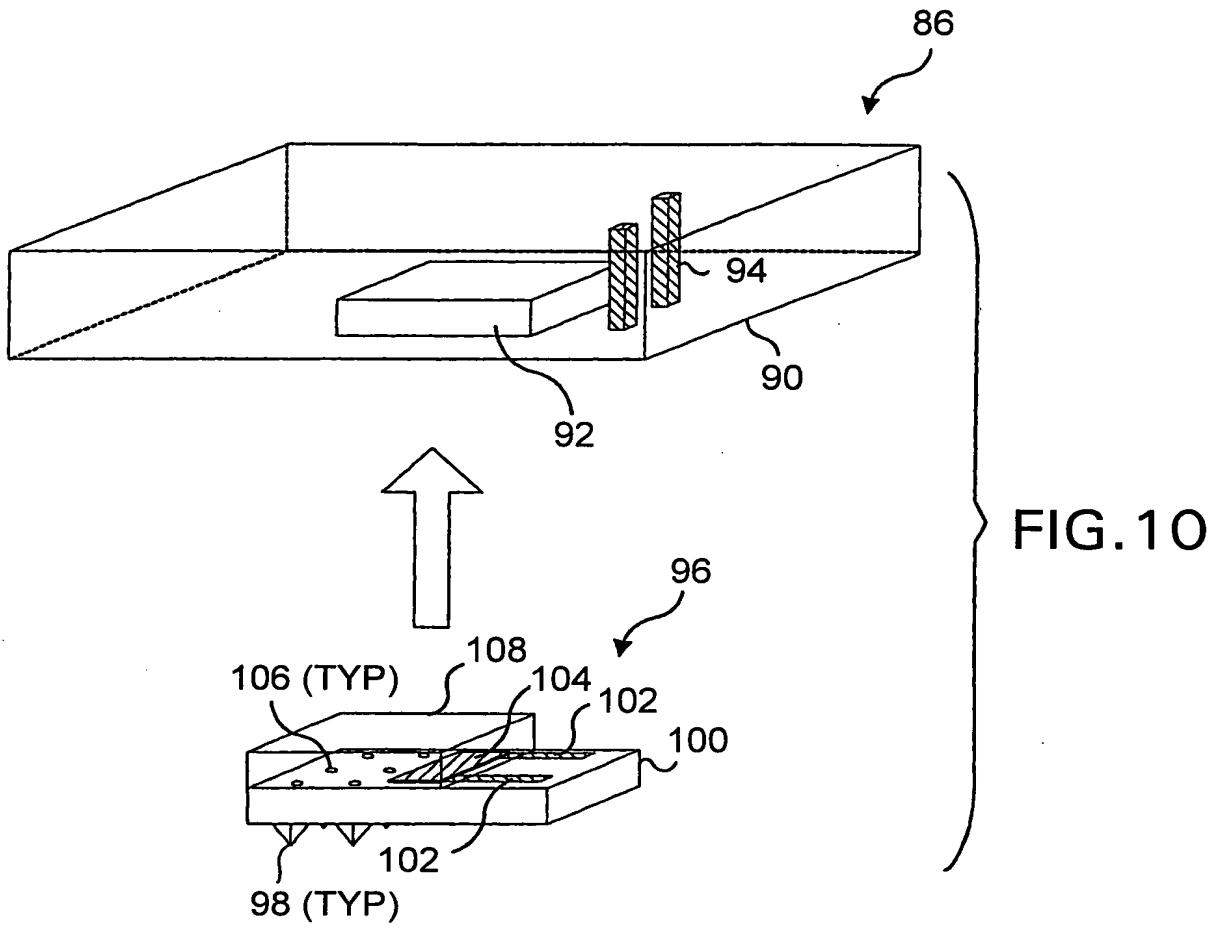


FIG. 9



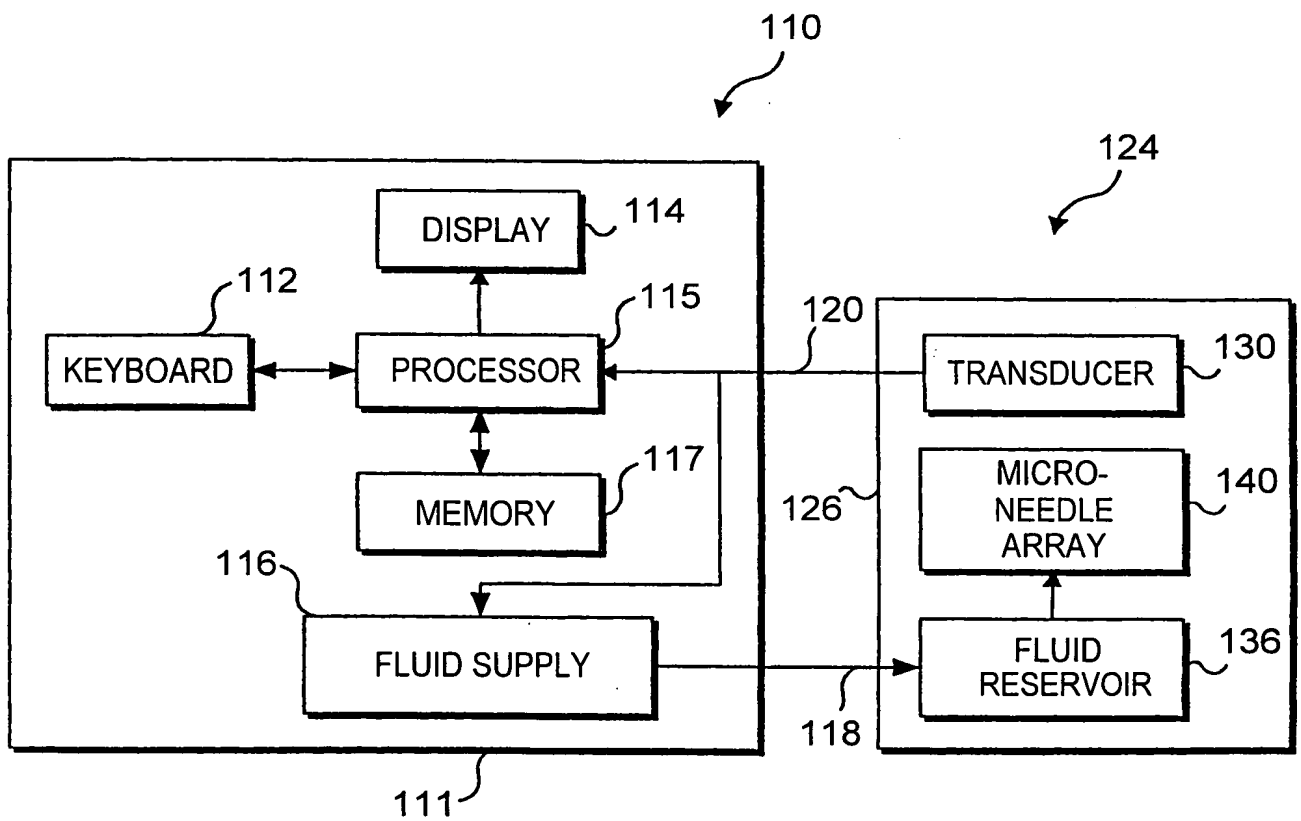
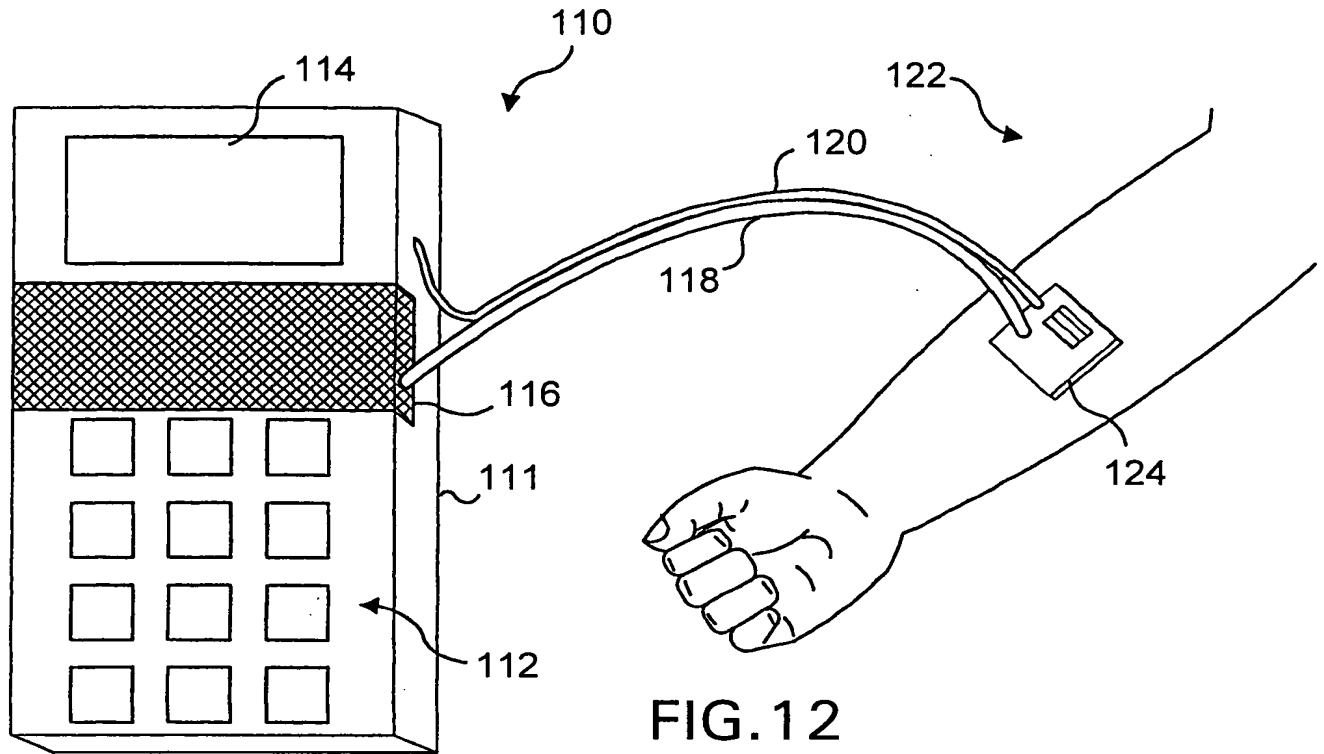


FIG. 13

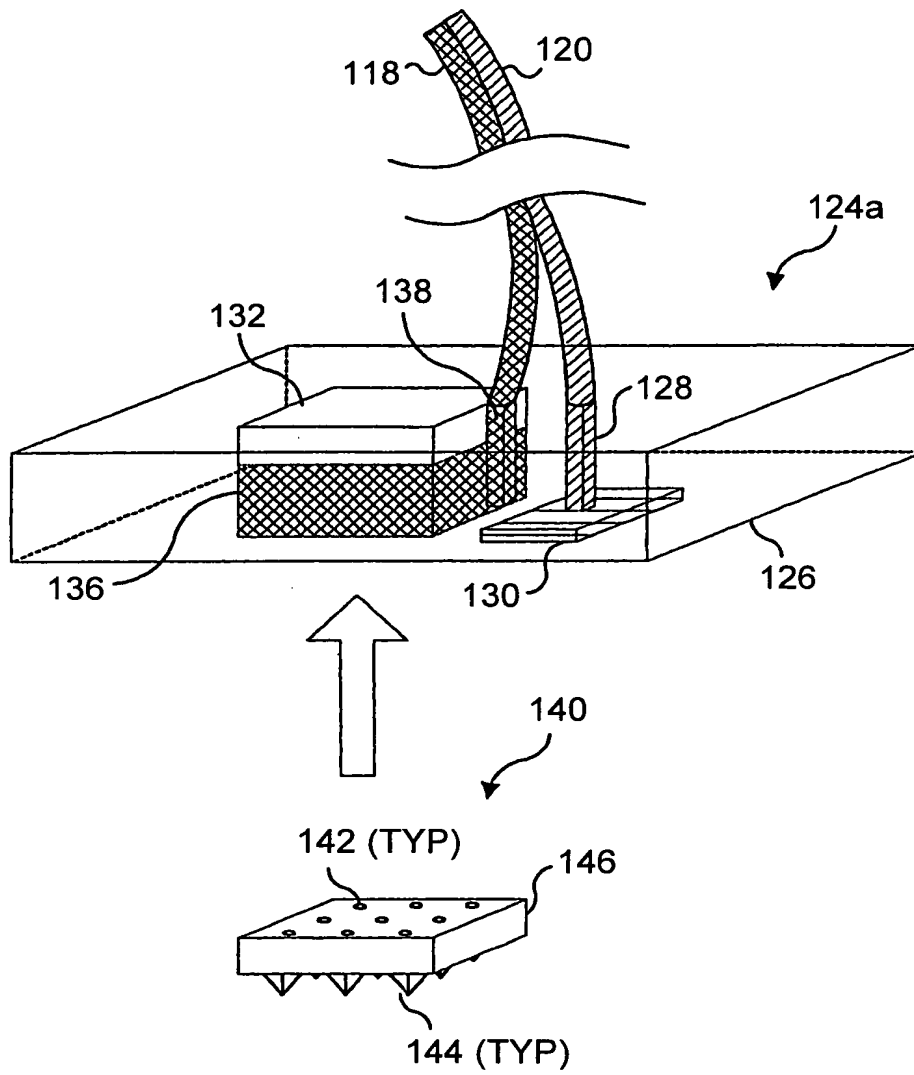


FIG. 14

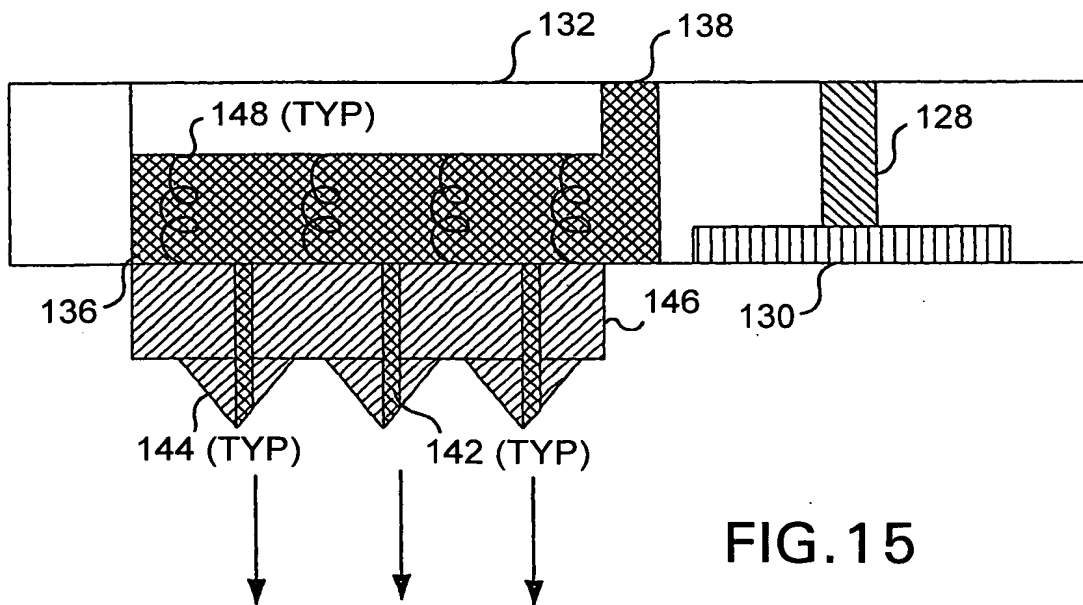


FIG. 15



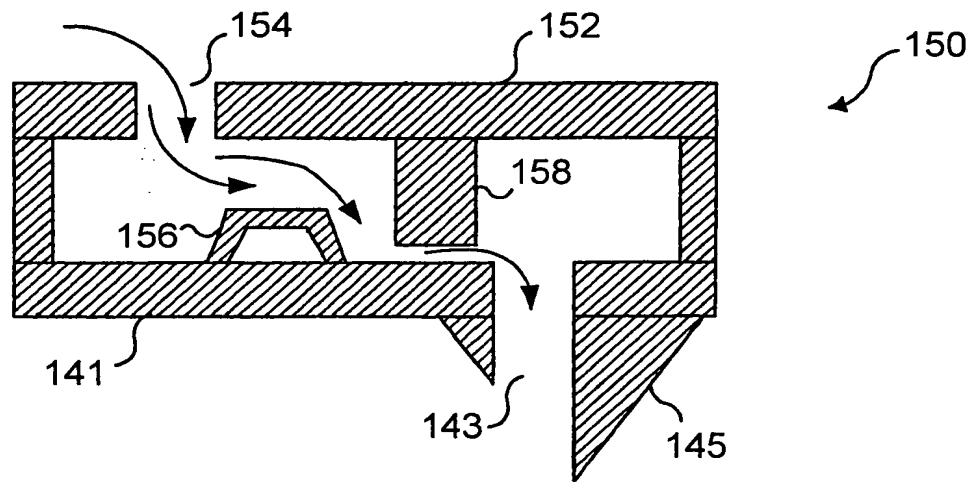


FIG. 16

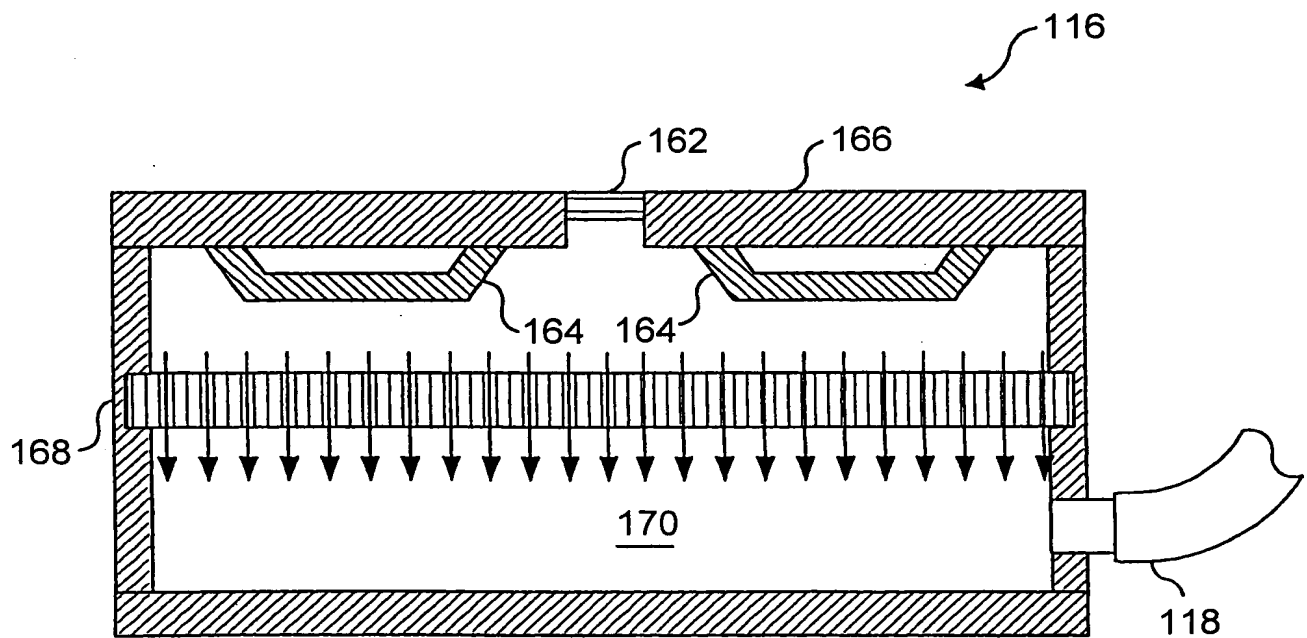


FIG. 17